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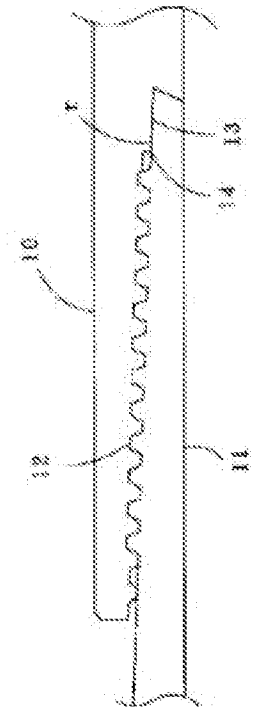
(54) MANGANESE PHOSPHATE CHEMICAL CONVERSION TREATING METHOD FOR OIL WELL TUBE JOINT MADE OF Cr-CONTAINING STEEL

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a manganese phosphate chemical conversion treating method for an oil well tube joint made of Cr-containing steel in which a manganese phosphate film is formed on the surface of the oil well tube joint.

SOLUTION: In this method for subjecting an oil well tube joint 10 produced by Cr-containing steel to manganese phosphate chemical conversion treatment, the oil well tube joint 10 is subjected to chemical conversion treatment by using a manganese phosphate chemical conversion treating solution in which the total acidity is controlled to 55 to 80 points, free acidity is controlled to 4.0 to 14.0 points, and further, acid ratio is controlled to 5.0 to 12.0, by which a manganese phosphate film is formed on the surface of the oil well tube joint 10.



CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1]It is the method of performing phosphoric acid manganese system conversion treatment to an oil well pipe joint manufactured with Cr content steel, Conversion treatment of said oil well pipe joint is carried out using phosphoric acid manganese system conversion treatment liquid which adjusted the degree of free acid to 4.0 to 14.0 points 55 to 80 point, and adjusted an acid ratio for total acidity to 5.0-12.0, A phosphoric acid manganese system conversion treatment method of a Cr content steel oil well pipe joint forming a phosphoric acid manganese system coat in the surface of this oil well pipe joint.

[Claim 2]It is the method of performing phosphoric acid manganese system conversion treatment to an oil well pipe joint manufactured with Cr content steel, Conversion treatment of said oil well pipe joint is carried out using phosphoric acid manganese system conversion treatment liquid which adjusted the degree of free acid to 4.0 to 14.0 points 55 to 80 point, and adjusted an acid ratio for total acidity to 5.0-12.0, A phosphoric acid manganese system conversion treatment method of a Cr content steel oil well pipe joint forming a phosphoric acid manganese system coat of 5-60 micrometers of film thickness in the surface of this oil well pipe joint.

[Claim 3]A phosphoric acid manganese system conversion treatment method of a Cr content steel oil well pipe joint characterized by carrying out surface adjustment processing of the surface of this oil well pipe joint for said oil well pipe joint before [said] carrying out conversion treatment in a phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint according to claim 1 or 2.

[Claim 4]A phosphoric acid manganese system conversion treatment method of a Cr content steel oil well pipe joint characterized by carrying out surface roughening processing of the surface of this oil well pipe joint for said oil well pipe joint before [said] carrying out conversion treatment in a phosphoric acid manganese system conversion treatment method of the Cr

content steel oil well pipe joint according to claim 1 or 2.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the conversion treatment method which forms a phosphoric acid manganese system coat in the surface of the oil well pipe joint manufactured with Cr content steel. Since it was manufactured with Cr content steel if stated in detail, phosphoric acid manganese system conversion treatment is related with the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint which forms a phosphoric acid manganese system coat in the surface of the difficult oil well pipe (it was hard to form coat) joint.

[0002]

[Description of the Prior Art]as the material of the conventional oil well pipe -- ordinary steel or chromium, and molybdenum -- several -- wt% -- the Cr-Mo steel to contain was used. However, the oil well pipe which demonstrates performances, such as corrosion resistance, enough also under the corrosion environment accompanied by H_2S or CO_2 has been called for as the conditions of an oil well become increasingly severe in recent years. Therefore, many oil well pipes manufactured with Cr content steel are used. Although this oil well pipe is used, for example for oil drilling, it connects with the joint (oil well pipe joint) provided with the thread part, and each oil well pipe (steel oil well casing) used for oil drilling is used. Here, each joint is using the bolting machine called power tongs, and is connected to each oil well pipe. However, since bolting [each joint / high torque] in the case of bolting, printing may be generated on the surface of a thread part. When printing occurs, by imperfect conclusion, there is a problem which causes airtight degradation and the fall of joint intensity. In order to prevent this printing, on the surface of a thread part, copper plating, galvanization, or phosphoric acid salt system coat processing is usually made. Among these, for the cheap and simple method, generally phosphoric acid salt system coat processing is adopted widely, for example, is indicated by JP,H5-40034,B, Tokuganhei5-134986, and JP,H1-12995,B.

[0003]

[Problem to be solved by the invention]However, there are the following problems in the above-mentioned method. Although it is indicating adding fluoride in phosphoric acid manganese system conversion treatment liquid, when it carries out to Cr content steel, the etching reaction by fluoride has priority, it starts in JP,H5-40034,B and there is a problem which the phosphoric acid manganese system coat to need cannot form easily in it. Tokuganhei5-134986 has disclosed the method of performing phosphoric acid salt processing

after forming a CHITSU-ized layer in Cr content steel surface. In this art, although a phosphoric acid manganese system coat can be formed to be sure, in order to perform CHITSU-ized processing, there is a problem that it is high-cost. On the other hand, in JP,H1-12995,B, the method of giving alloy plating to the thread part of a joint is indicated. Although this art is also printed and it is effective for prevention, it is high-cost too. Therefore, in the phosphoric acid salt system coat processing to steel containing Cr beyond 1wt%, the present condition is that the simple method is not proposed inexpensive moreover. This invention was made in view of this situation, and an object of this invention is to provide the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint which forms a phosphoric acid manganese system coat in the surface of the oil well pipe joint manufactured with Cr content steel.

[0004]

[Means for solving problem][the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint concerning the 1st invention in alignment with said purpose] It is the method of performing phosphoric acid manganese system conversion treatment to the oil well pipe joint manufactured with Cr content steel, Using the phosphoric acid manganese system conversion treatment liquid which adjusted the degree of free acid to 4.0 to 14.0 points 55 to 80 point, and adjusted the acid ratio for total acidity to 5.0-12.0, conversion treatment of the oil well pipe joint is carried out, and a phosphoric acid manganese system coat is formed in the surface of an oil well pipe joint. Here, total acidity (TA:Total Acid, a unit: point) is obtained by taking phosphoric acid manganese system conversion treatment liquid 10 mL (with hole pipette), and titrating with NaOH solution of 0.1N by using phenolphthalein as an indicator. The amount of titration at this time (mL) is considered as the point. The degree of free acid (FA:Free Acid, a unit: point) is obtained by taking phosphoric acid manganese system conversion treatment liquid 10 mL (with hole pipette), and titrating with NaOH solution of 0.1N by using BUROMU phenol blue as an indicator. The amount of titration at this time (mL) is considered as the point. And an acid ratio (AR:Acid Ratio) is an arithmetical computation value of (total acidity (TA))/(the degree of free acid (FA)). Since chemical reaction sufficient in the contact portion (interface) of the surface of an oil well pipe joint and phosphoric acid manganese system conversion treatment liquid can be started by this, it becomes possible to form the phosphoric acid manganese system coat excellent in the conventionally difficult printing-proof nature in the surface of an oil well pipe joint.

[0005][the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint concerning the 2nd invention in alignment with said purpose] It is the method of performing phosphoric acid manganese system conversion treatment to the oil well pipe joint manufactured with Cr content steel, Using the phosphoric acid manganese system conversion treatment liquid which adjusted the degree of free acid to 4.0 to 14.0 points 55 to

80 point, and adjusted the acid ratio for total acidity to 5.0-12.0, conversion treatment of the oil well pipe joint is carried out, and the phosphoric acid manganese system coat of 5-60 micrometers of film thickness is formed in the surface of an oil well pipe joint. Chemical reaction sufficient in the contact portion (interface) of the surface of an oil well pipe joint and phosphoric acid manganese system conversion treatment liquid can be started by this, And it becomes possible to form in the surface of an oil well pipe joint to such an extent that there is no possibility that printing may generate the film thickness of a phosphoric acid manganese system coat excellent in the conventionally difficult printing-proof nature.

[0006]Here, in the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint concerning the 1st and 2nd invention, before carrying out conversion treatment of the oil well pipe joint, surface adjustment processing of the surface of an oil well pipe joint may be carried out. The above-mentioned surface adjustment processing means the disposal method used by the usual phosphoric acid manganese system conversion treatment. It becomes possible to make precise small the coat crystal of the phosphoric acid manganese system coat formed in the surface of an oil well pipe joint by this. In the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint concerning the 1st and 2nd invention, before carrying out conversion treatment of the oil well pipe joint, surface roughening processing of the surface of an oil well pipe joint may be carried out. Thereby, surface area of an oil well pipe joint can be made large, and it becomes possible to remove a surface oxide film moreover.

[0007]that is, according to this invention, the conventionally difficult phosphoric acid manganese system coat (a phosphoric acid manganese system -- transformation -- it is also called a coat) can be formed in the surface of the oil well pipe joint manufactured with Cr content steel. A phosphoric acid manganese system coat is formed in following order. By carrying out conversion treatment of the material (oil well pipe joint) using phosphoric acid manganese system conversion treatment liquid (henceforth conversion treatment liquid), the material surface is etched (elution of iron of a material) and the reduction reaction of a hydrogen ion occurs in that case (reduction in a hydrogen-ion density). Therefore, in the contact portion (interface) of the material and conversion treatment liquid in which the etching reaction has occurred, the rise of pH takes place, and the precipitation reaction of phosphoric acid manganese occurs continuously. If this precipitation reaction occurs on the material surface, it will mean that the coat had deposited (coat formation). This invention is adjusting and managing conversion treatment liquid on the above-mentioned conditions (total acidity, the degree of free acid, an acid ratio), It finds out that formation of a phosphoric acid manganese system coat is able to cause a phosphoric acid manganese system coat formation reaction (an etching reaction and a precipitation reaction) also on the surface of difficult Cr content steel.

[0008]

[Mode for carrying out the invention]Then, referring to the attached Drawings, it explains per [which materialized this invention] embodiment, and an understanding of this invention is presented. It is an explanatory view of the oil well pipe joint which applies here the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint which requires drawing 1 for the 1 embodiment of this invention.

[0009]the oil well pipe joint 10 which applies the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint concerning the 1 embodiment of this invention as shown in drawing 1 -- Cr -- 1.0 - 13.0wt% -- it consists of steel to contain and both oil well pipe 11 (not shown [the oil well pipe of another side]) is connected. Hereafter, it explains in detail. This oil well pipe joint 10 is called a pipe joint (coupling joint), and, [the oil well pipe joint 10] When connecting both oil well pipe 11 with the oil well pipe joint 10, the thread part 12 of the oil well pipe 11 finishes, and the metal metal seal part 13 which a tip makes the taper of point ** and contacts from it in view of the oil well pipe 11 is formed. And the circle seal part 14 which has a center of curvature in the entrance part of this metal metal seal part 13 at the oil well pipe joint 10 side is formed in the oil well pipe joint 10. Therefore, by carrying out rotation bolting of the oil well pipe joint 10, press fit cost is given to the metal metal seal part 13 and the circle seal part 14, and it becomes possible to make a contact surface generate high planar pressure, and to plan a seal. As the curvature radius r of the circle seal part 14, conventionally, 1-4 mm is adopted in the object for airtight (1000-2000 atmospheres), and 200-300 mm is adopted by the object (hundreds of atmospheres) for inside airtight.

[0010]Then, the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint concerning the 1 embodiment of this invention is explained using the above-mentioned oil well pipe joint 10. The phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint concerning the 1 embodiment of this invention is a method of performing phosphoric acid manganese system conversion treatment to the oil well pipe joint 10 manufactured with Cr content steel. The oil well pipe joint 10 manufactured with Cr content steel usually **** antirust oil, and is kept. Therefore, in order to perform phosphoric acid manganese system conversion treatment of this embodiment, the process of removing the antirust oil ****(ed) by the surface of the oil well pipe joint 10 to process ******(ing) is required. Then, degreasing (antirust oil removal) of the surface of the oil well pipe joint 10 is performed using alkaline degreasing, ****, solvent degreasing, solvent steamy degreasing, etc. However, alkaline degreasing is preferred in order to secure 10 Bunsui ******. After degreasing, excessive alkaline degreasing liquid and solvent are removed by a flush, ****, etc.

[0011]Next, before carrying out conversion treatment of the oil well pipe joint 10, it is also possible to carry out surface roughening processing of the surface of the oil well pipe joint 10

according to conditions, such as the environment. as this surface roughening processing -- a shot blast, a sandblast, and Scotch whisky -- physical methods, such as being bright (registered trademark), and a chemical method which is called pickling which uses chloride, ** fluoric acid, etc. are mentioned. However, in the case of the physical roughening method, in order to remove polish dregs and abrasive soap, the process of performing degreasing processing of the surface of the oil well pipe joint 10, or performing a flush and **** in the case of pickling, and removing acid with the excessive surface of the oil well pipe joint 10 is required. Thereby, surface area of the oil well pipe joint 10 can be made large, and since the oxide film of the surface of the oil well pipe joint 10 is removable, the phosphoric acid manganese system conversion treatment nature (shortening of conversion treatment time) of this embodiment can be improved, and also printing nature can be improved.

[0012]It is also possible to carry out surface adjustment processing of the surface of the oil well pipe joint 10 for the oil well pipe joint 10 after degreasing of the surface of the oil well pipe joint 10 or the above-mentioned surface roughening processing, before [said] carrying out conversion treatment. The disposal method used by the usual phosphoric acid manganese system conversion treatment may be adopted as this surface adjustment processing. this processing -- a phosphoric acid manganese system -- transformation -- the coat crystal of a coat can be small made precise, and film thickness adjustment can be performed, and also phosphoric acid manganese system conversion treatment nature can be improved.

[0013]Subsequently, although it is the phosphoric acid manganese system conversion treatment of this embodiment, said -- as carried out, 55 to 80 point, the degree of free acid was adjusted to 4.0 to 14.0 points, and the acid ratio was adjusted for total acidity to 5.0-12.0 -- phosphoric acid manganese system conversion treatment liquid, i.e., conversion treatment liquid, is warmed to the temperature of which 60 **- boil is done first. The oil well pipe joint 10 is immersed in this warmed conversion treatment liquid, or this conversion treatment liquid is blown by a spray, and conversion treatment of the oil well pipe joint 10 is carried out. Although conversion treatment time is 5 to 120 minutes, the time of actually required conversion treatment changes with the temperature of surface roughening processing, surface adjustment processing, and conversion treatment liquid. Therefore, as for these conditions, it is preferred to see the situation of the phosphoric acid manganese system coat formed, and to choose arbitrarily the conditions which can take profit industrially. This forms the phosphoric acid manganese system coat of 5-60 micrometers of film thickness in the surface of the oil well pipe joint 10. And it dries, after washing or ****(ing) the oil well pipe joint 10 in which the phosphoric acid manganese system coat was made to form and flushing excessive conversion treatment liquid. Although a drainer dryness grade is enough as dryness, it is preferred to put in the oven of 60-120 ** atmosphere, and to remove moisture. If moisture remains, before using the oil well pipe joint 10, it may be generated by rust on the surface of the oil well pipe joint 10.

[0014]Then, the Reason for a numerical limitation etc. of the ingredient of the above-mentioned conversion treatment liquid, the total acidity which constitutes conversion treatment liquid, the degree of free acid, an acid ratio, and the film thickness of a phosphoric acid manganese system coat are explained in detail hereafter. There are a system (PO_4^{3-}-NO_3^--Mn^{2+}-nickel^{2+}) which contains the first phosphoric acid manganese as the main ingredients, and a system (PO_4^{3-}-NO_3^--Mn^{2+}-Zn^{2+}-nickel^{2+}) in the conversion treatment liquid of this embodiment. Total acidity the degree of free acid among these ingredients depending on the concentration of the acid (anion) of PO_4^{3-} and NO_3^- Anions, such as PO_4^{3-} and NO_3^-, Depending on balance with cations, such as Mn^{2+}, Zn^{2+}, and nickel^{2+}, an acid ratio is dependent on the balance of the whole conversion treatment liquid. Therefore, in manufacture of conversion treatment liquid, it is important like this embodiment to adjust these figures properly.

[0015]Therefore, as for the total acidity of the conversion treatment liquid of this embodiment, it is preferred to consider it as 55 to 80 points, as described above. Since it requires great time and cannot take profit industrially even if this cannot fully perform coat formation to a material as total acidity is less than a lower limit, or it can perform coat formation, it originates in it not being desirable. On the other hand, if a maximum is exceeded, the effect of coat formation will be saturated, it is industrially uneconomical, and since sludge is generated so much in conversion treatment liquid, it is not desirable. Therefore, although total acidity of conversion treatment liquid was made into 55 to 80 points, it is most preferred to consider it as 58 to 75 points and also 60 to 70 points more preferably.

[0016]As for the degree of free acid, it is preferred to consider it as 4.0 to 14.0 points, as described above. Since this generates sludge so much in conversion treatment liquid as the degree of free acid is less than a lower limit, it originates in it not being desirable. On the other hand, it is not desirable in order for an etching reaction of a material to increase and to check formation of a phosphoric acid manganese system coat, if a maximum is exceeded. Therefore, although the degree of free acid of conversion treatment liquid was made into 4.0 to 14.0 points, it is most preferred to consider it as 5.0 to 13.0 points and also 5.0 to 12.0 points more preferably.

[0017]As for an acid ratio, it is preferred to be referred to as 5.0-12.0 as described above. Since etching reaction of this of a material increases that an acid ratio is less than a lower limit, it checks formation of a phosphoric acid manganese system coat and generates SUMATTO (for example, black foreign substance etc. which remained in the material surface on the time of pickling, or the occasion of alkali treatment) depending on the case, it originates in it not being desirable. On the other hand, if a maximum is exceeded, an effect is saturated and it is industrially uneconomical, and since sludge is generated so much in conversion treatment

liquid, it is not desirable. Therefore, although an acid ratio of conversion treatment liquid set to 5.0-12.0, it is preferred to use more preferably 6.0-10.0, and also 6.0-8.0.

[0018]Although adjustment in particular of total acidity of this embodiment, free acid, and an acid ratio is not limited, in order to make high a point of total acidity and the degree of free acid, it adds acid, such as phosphoric acid and nitric acid, for example. On the contrary, although it does not limit in particular to when making it fall, adding alkali metal salt, carbonate (carbonic acid Mn, carbonic acid Zn) of a heavy metal, basic carbonate, an oxide, hydroxide, etc. is mentioned as an example. These addition enables it to adjust total acidity of conversion treatment liquid, the degree of free acid, and an acid ratio.

[0019]As for the film thickness of the phosphoric acid manganese system coat of this embodiment, it is preferred to be referred to as 5-60 micrometers as described above. This originates in the improvement effect of the printing-proof nature according that film thickness is less than a lower limit to a phosphoric acid manganese system coat not being acquired. On the other hand, if a maximum is exceeded, an effect is saturated and it is not economical. therefore, a phosphoric acid manganese system -- transformation -- although the film thickness of the coat set to 5-60 micrometers, it is most preferred that they are 10-40 micrometers and also 10-30 micrometers more preferably.

[0020]The above mentioned conversion treatment liquid may also contain a fluorine ion at 0.2 g/L or less. However, if content exceeds 0.2 g/L, the etching reaction of a material will become excessive, and coat formation will be checked, and also it will become easy to produce the fault of SUMATTO adhering to the material surface. And conversion treatment liquid may also contain 0.3-5.0 g/L Fe^{2+} further. if Fe^{2+} is included in this range, conversion treatment (reaction) will be promoted -- transformation -- time can be shortened. however -- if it separates from this range -- transformation -- sludge may increase, or the crystal of the phosphoric acid manganese system coat formed may become large, and the fall of printing-proof nature may be caused.

[0021]

[Working example]The phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint concerning this invention is applied, and the result of having examined is explained. 0. 177.8 mm of outer diameters manufactured as object for corrosion resistance with 20wt%C-0.20wt%Si-3.0wt%Cr-0.5wt%Mo steel, Phosphoric acid manganese system conversion treatment of the various conditions shown in Table 1 was performed to the steel oil well casing screw joint (oil well pipe joint) of the thickness of 11.5 mm, and the API standard L80. Bolting of the steel oil well casing screw joint manufactured on these conditions and the result of having fastened and having done the return examination are also collectively shown in Table 1.

[0022]

[Table 1]

	No	りん酸マンガン系化成処理					表面調整処理	表面粗化処理（サンドブラスト）	膜厚（μm）	締め付け締め戻し試験結果
		全酸度（ポイント）	遊離酸度（ポイント）	酸比（－）	温度（℃）	時間（分）				
本発明例	1	60.8	5．9	10.3	93±3	50	なし	なし	15	10回まで焼き付きなし
	2	56.0	6．9	8.1	93±3	50	あり	なし	18	10回まで焼き付きなし
	3	76.1	7．6	10.0	93±3	50	なし	なし	30	10回まで焼き付きなし
	4	76.1	7．6	10.0	93±3	30	あり	なし	28	10回まで焼き付きなし
	5	76.1	7．6	10.0	93±3	30	なし	あり	22	10回まで焼き付きなし
	6	76.1	7．6	10.0	93±3	25	あり	あり	25	10回まで焼き付きなし
比較例	7	50.0	10．0	5.0	93±3	50	なし	なし	5	3回でシール部に焼き付き発生
	8	49.1	6．9	7.1	93±3	50	なし	なし	7	5回でシール部に焼き付き発生

[0023]Usually, printing all did not generate the examples 1-6 of this invention to 10 times to printing having generated the comparative examples 7 and 8 of the steel oil well casing screw joint which processed in several times. [namely the thing for which the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint of this invention is applied to a steel oil well casing screw joint] Since it was conventionally manufactured with Cr content steel, it turns out that it enabled phosphoric acid manganese system conversion treatment to form stably the phosphoric acid manganese system coat excellent in printing-proof nature in the surface of the difficult steel oil well casing screw joint.

[0024]As mentioned above, although this invention has been explained with reference to 1 embodiment, this invention is not limited to composition given in the embodiment above-mentioned in any way, and also includes the other embodiments and modifications which are considered within the limits of the matter indicated to Claims.

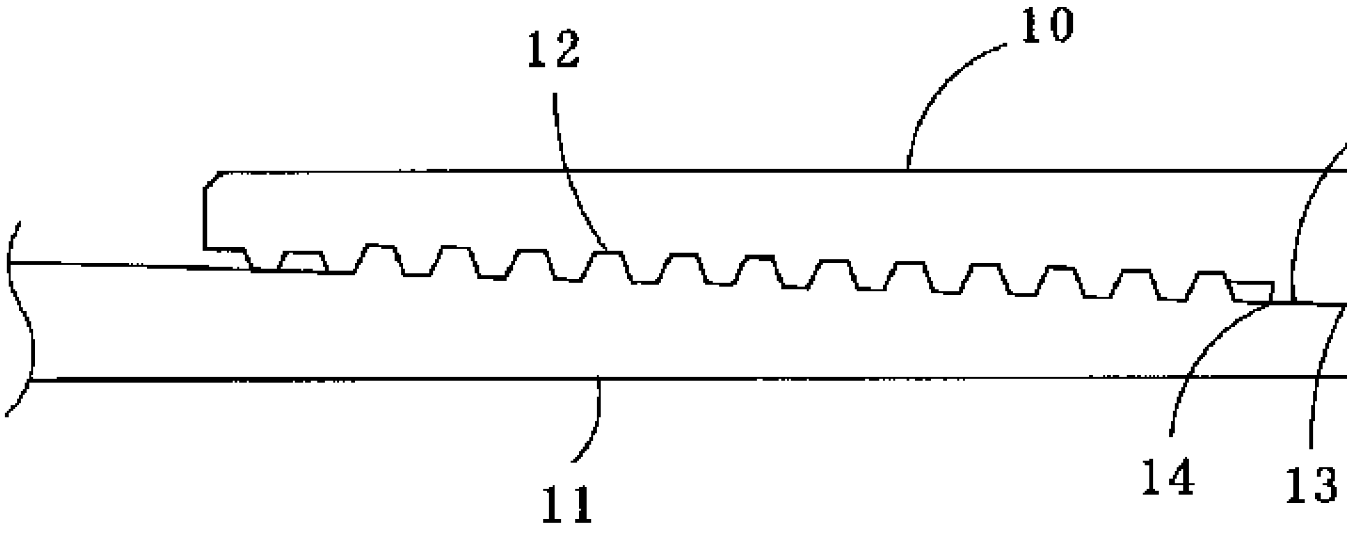
[0025]

[Effect of the Invention]In the phosphoric acid manganese system conversion treatment method of Claim 3 and the Cr content steel oil well pipe joint of four descriptions subordinate to Claim 1 and this, Since chemical reaction sufficient in the contact portion (interface) of the surface of an oil well pipe joint and phosphoric acid manganese system conversion treatment liquid can be started, it becomes possible to form the phosphoric acid manganese system coat excellent in the conventionally difficult printing-proof nature in the surface of an oil well pipe joint. Therefore, it excels in printing-proof nature and, moreover, the oil well pipe joint which

demonstrates performances, such as corrosion resistance, enough can be manufactured also under the corrosion environment accompanied by H_2S or CO_2. In the phosphoric acid manganese system conversion treatment method of Claim 3 and the Cr content steel oil well pipe joint of four descriptions subordinate to Claim 2 and this, Chemical reaction sufficient in the contact portion (interface) of the surface of an oil well pipe joint and phosphoric acid manganese system conversion treatment liquid can be started, And it becomes possible to form in the surface of an oil well pipe joint to such an extent that there is no possibility that printing may generate the film thickness of a phosphoric acid manganese system coat excellent in the conventionally difficult printing-proof nature. Therefore, it excels in economical efficiency or printing-proof nature, and, moreover, the oil well pipe joint which demonstrates performances, such as corrosion resistance, enough can be manufactured also under the corrosion environment accompanied by H_2S or CO_2.

[0026]In particular, in the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint according to claim 3, it becomes possible to make precise small the coat crystal of the phosphoric acid manganese system coat formed in the surface of an oil well pipe joint. Therefore, the film thickness of a phosphoric acid manganese system coat can be adjusted, and it becomes possible to raise phosphoric acid manganese system conversion treatment nature (shortening of conversion treatment time) moreover. In the phosphoric acid manganese system conversion treatment method of the Cr content steel oil well pipe joint according to claim 4, surface area of an oil well pipe joint can be made large, and it becomes possible to remove a surface oxide film moreover. Therefore, phosphoric acid manganese system conversion treatment nature can be improved, and it becomes possible to raise printing-proof nature moreover.

[Translation done.]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